# Effects of water pollution on fecundity of selected fish species from Godavari River, Nanded, Maharashtra

A

Synopsis

Submitted to

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
NANDED

(M.S.)

For the registration of

## Doctor of Philosophy

In Zoology

(Faculty of Science & Technology)

By

**Mr. Biyabani Munibuddin Muntajebuddin**

(M.Sc. B.Ed, PET.)

Under the Guidance of

**Dr. Malviya Mamata Kashiramji**

Associate Professor, Head Department of Zoology,

Pratibha Niketan college,

Nanded (M.S.)

# Effects of Water pollution on fecundity of selected fish species from Godavari River, Nanded, Maharashtra.

## INTRODUCTION:

India is an agriculture-based country where a large portion of the population depends on farming and related activities for their livelihood. Agriculture forms the backbone of our economy, especially in regions like Nanded, located along the banks of the Godavari River, where it is the primary source of income. However, in the race for modern development, environmental and water resources are being increasingly neglected. Rivers, which have long been considered lifelines, are now facing the severe impact of pollution. According to the Central Pollution Control Board **(CPCB)**, pollution refers to the presence of harmful substances in the environment such as air, water, soil, or noise that negatively impact human health, wildlife, and ecosystems.

In today's time, people are more focused on agricultural production, industrialization, and urbanization, while the issues of water pollution and the condition of aquatic life, especially fish, are often overlooked. Without realizing the consequences, people are using polluted water sources, leading to serious threats not only to human health but also to aquatic ecosystems.

To increase crop yield, farmers extensively use chemical fertilizers and pesticides. During the rainy season, these chemicals get washed into the Godavari River, degrading the water quality. Similarly, industrial waste and domestic sewage also flow directly into the river. This pollution not only contaminates the water but also severely affects the health and fecundity (reproductive capacity) of fish living in the river.

Fish are not only an important part of the human food chain but also serve as indicators of water quality and ecological balance. Toxic substances that accumulate in the bodies of fish reduce the number and quality of their eggs, posing a serious threat to fish populations in the future.

The most alarming fact is that local people often catch and consume these fish from polluted waters or sell them in the market. As a result, they unknowingly consume toxic chemicals, which can negatively affect their own health and reproductive abilities.

Polluted water usually contains harmful chemicals that can be fatal, toxic and harmful to fish and humans like Herbicides, insecticides, fungicides, rodenticides, molluscicides, and nematicides can contaminate water. These pesticides, when sprayed on crops, can enter water sources through rain, irrigation, and runoff. Polluted water containing pesticides like

herbicides, insecticides, fungicides, rodenticides, molluscicides, and nematicides has a severe impact on fish health. These chemicals disrupt their **metabolism, growth, reproduction, and immune system**, leading to physiological damage such as changes in blood parameters, reduced oxygen levels, and toxic accumulation in vital organs like the liver and kidneys. Behavioral changes, including altered swimming patterns and feeding habits, can also occur, weakening their survival instincts. Additionally, pesticide exposure affects hormonal balance, reducing fish growth and reproductive capabilities, while long-term exposure increases mortality rates and disturbs the aquatic ecosystem. Addressing this issue requires better **water pollution control** and **sustainable agricultural practices** to protect aquatic life.

Nowadays, people are more attracted to the taste of fish dishes, but rarely do they think about the health of the fish or their natural habitats. The Godavari River, which flows through Nanded in Maharashtra, has been a lifeline for fishermen and local communities for centuries. However, increasing industrialization, agricultural runoff, and domestic waste are polluting the river at an alarming rate. This pollution not only deteriorates water quality but also deeply impacts the reproductive health of the fish living in it. During the course of this research, utmost care will be taken to ensure that no form of negligence occurs.

Fish of different age groups—pre-mature, mature, and post-mature—as well as various species, will be selected. These fish will be collected from two sites: one with low pollution (Station 1) and the other with high pollution (Station 2).

All procedures will be conducted with complete honesty, sincerity, and scientific integrity. No aspect of ethics will be compromised at any stage of the study. Furthermore, special attention will be given to environmental sustainability, and every step of the research will be carried out with due respect and responsibility towards nature and aquatic life.

### Need and Objective of the Study

The main objective of this study is to analyze the impact of pollution particularly from agricultural, industrial, and domestic sources on the fecundity of some selected fish species from the Godavari River in Nanded. This research aims to understand how water pollution is affecting the number and quality of fish eggs and what long-term consequences it may lead to.

This study is not only crucial for the conservation of aquatic life but also aims to raise awareness among local communities and promote sustainable agriculture and fisheries.

## Local Research:

Nanded is located on the banks of river Godavari in west-central India. In the present investigation, the COD values are higher compared to the standard values of WHO and ICMR, indicating a greater pollution of Godavari River water due to M.I.D.C. effluents. This clearly demonstrates that the river water is not suitable for potable use, recreational activities, and historical purposes. Therefore, it is necessary to discharge the M.I.D.C. effluents after

proper treatment by the authorities of the industries. According to the author, the water of the Godavari River is polluted in the city of Nanded.

In the city of Nanded (Taluka), there are three important bridges because these bridges are used by the residents of Nanded. These bridges are Monda bridge, Naavghat bridge, and the third one is Wajegaon bridge. During the course of the Godavari River at Naavghat and Wajegaon bridge, pollution is predominantly observed due to the higher population concentration in those areas.

The Naavghat Bridge is relatively small in size, making it easier to catch fish here. Near the Wajegaon Bridge, we found a lot of garbage. Along the route to Degloor Naka (north), a significant amount of litter is visible. At the location of Wajegaon, there are numerous brick kilns.

Many people are unaware of this issue and lack the necessary knowledge and awareness about pollution and its impacts. Various pollutants entering the water are having harmful effects on fish, affecting both their health and reproductive capacity. Our objective is to protect the Nanded region from water pollution so that it does not negatively impact the fish and the people who consume them. Additionally, we aim to raise public awareness so that individuals can actively participate in preserving water resources and maintaining ecological balance.

## Effect of pollution on fish fecundity:

Water pollution has a significant negative impact on the **fecundity** of fish, affecting their reproductive health and ability to lay eggs. Here are some key effects:

1. **Reproductive Disruptions** – Pollutants can interfere with fish reproductive systems, causing issues like **hormonal imbalance**, **organ damage**, and **low egg production**.
2. **Reduced Oxygen Levels** – Pollution decreases **dissolved oxygen** in water, making it harder for fish to survive and affecting their ability to reproduce effectively.
3. **Destruction of Habitats** – Polluted water can harm essential aquatic plants and microorganisms that support fish reproduction, reducing their ability to find suitable spawning sites.
4. **Heavy Metals & Toxic Chemicals** – Contaminants like **lead, mercury, and pesticides** disrupt reproductive processes, leading to lower fecundity and poor egg viability.
5. **Physical & Histopathological Damage** – Pollutants can harm fish organs such as the **gills, liver, and kidneys**, affecting their overall health and reproductive success.

Water pollution is a serious threat to aquatic ecosystems and biodiversity. Taking

measures to **reduce industrial waste, control agricultural runoff, and ensure clean water sources** is crucial for protecting fish populations.

## Review of literature:

1)Freshwater is crucial for life, but pollution from human activities like industrial waste, chemicals, and mining is making most of it unfit for use. This pollution harms aquatic life, especially fish, by affecting their growth, reproduction, and organ health. Histopathological changes in fish organs like gills, liver, and kidneys show the damaging effects of pollutants. Water pollution not only threatens aquatic ecosystems but also affects food quality and public health. To reduce these impacts, strict pollution control, public awareness, and sustainable practices are necessary. Protecting clean water is vital for healthy fish populations and global food security. (Agrawal, et al., 2010)

2) A detailed investigation was carried out to evaluate the water quality of the downstream section of the Godavari River near Nashik city and to understand its impact on the Nashik Thermal Power Station at Eklahare. Water samples were collected monthly from six different locations between March 2007 and February 2008. These samples were then tested for various physical and chemical characteristics using standard procedures. Over time, the pollution levels in the river water have been rising, mainly due to the direct discharge of sewage, industrial effluents, and other waste into the river. The Godavari River water is widely used for domestic purposes, industries, farming, and also in large quantities by the thermal power plant for electricity production. The main aim of this study was to analyze the current water quality of the Godavari River and to assess how the contaminated water might be affecting the surrounding environment and human use. (P. R. Shaikh, et al., 2021)

3) Rivers are being polluted by both natural and human activities, harming water quality and threatening aquatic life. This calls for urgent conservation efforts. To assess

pollution levels in the Godavari River, a study was conducted between November 2008 and October 2009 at five sites. Various physical, chemical, and biological parameters—like pH, turbidity, dissolved oxygen, nutrients, heavy metals, and plankton—were analyzed.
The results showed significant pollution, and it was recommended that Nashik Municipal Corporation take steps to control pollution and ensure the river water is treated properly before being used for drinking. (B. B. Waykar et al., 2012)

4) In the polluted area of the Flix reservoir, fish such as common carp, roach, and pumpkinseed showed higher rates of body deformities and parasites. These fish also had reduced body condition, liver weight, gonadal weight, and fewer mature eggs compared to fish from cleaner upstream sites. These effects suggest that pollution negatively impacts fish health and reproduction. Even downstream, signs of pollution were visible, possibly due to the movement of pollutants. Interestingly, even pollution-tolerant species like common carp showed clear signs of reduced fitness in the affected area. (Josep Benito et al,. 2009)

## Research plan:

Year wise plan of work and target to be achieved.

**year 1 (First 12 Months)**

**1. Literature Survey and Problem Identification:**

- Review of existing literature related to river pollution and its effects on aquatic life.
- Identification of key sources of pollution in the Godavari River (Nanded region).

**2. Preliminary Field Survey and Species Selection:**

- Field visits to identify pollution hotspots.
- Selection of sampling sites and suitable fish species based on ecological and commercial relevance

**3. Compilation and Initial Analysis:**

- Collection and preliminary compilation of field and lab data.
- Basic statistical analysis and graphical representation.
- Submission of Year-1 Progress Report.

**Year 2 (Next 12 Months)**

**1. Biological Data Analysis:**

- Measurement of length and weight of selected fish species.
- Detailed study of fecundity (reproductive potential) in selected fish species.

**2. Data Compilation and Statistical Analysis:**

- Comprehensive data collection across sampling sites.
- Application of advanced statistical methods for comparison and correlation.
- Submission of Year-2 Progress Report.

**Final 6 Months (Half Year)**

**1. Recommendation and Conclusion:**

- Evaluation of pollution impact and formulation of recommendations for pollution mitigation in Nanded region.

**2. Research Communication:**

- Preparation and submission of research papers for national and international journals.
- Presentation of research findings at national/international conferences.

**3. Final Documentation:**

- Preparation and submission of final Ph.D. synopsis, preparation of pre-Ph.D. viva,
- Final submission of Ph.D. thesis.

## Aim and objectives of Research:

1. Sampling Site Selection: To select two sampling stations along the Godavari River — one with relatively low pollution and the other with high pollution levels.

2. Fish Identification and Selection: To identify and select three different fish species from each site for study, and carry out proper taxonomic classification.

3. Water Quality Analysis: To collect water samples from both stations and perform laboratory analysis of physico-chemical parameters to evaluate pollution intensity.

4. Fecundity Estimation: To estimate the fecundity (egg production) of the selected fish species using standard biological methods.

5. Pollution Impact Assessment: To assess and compare the effects of varying pollution levels on fish fecundity between the two sampling sites.

**Methodology to be adopted:**

**4.1. Study Area and Sampling Sites**

The primary study area will encompass the Godavari River within the Nanded district of Maharashtra. To capture the spatial variability of pollution, sampling sites will be strategically selected to represent different pollution influences:

1. Upstream Control Site: A relatively unpolluted stretch upstream of Nanded city, ideally before major anthropogenic inputs, to serve as a baseline for comparison.
2. Urban/Domestic Effect Sites: Locations within Nanded city where significant domestic sewage and solid waste discharge occur, particularly at Nava Ghat and areas near drainage channels (nullahs).
3. Industrial Effect Sites: Areas downstream of the MIDC industrial estate, specifically where effluents from pharmaceutical, textile, dairy, fertilizer, and tin industries are discharged.
4. Agricultural Runoff Effect Sites: Stretches adjacent to intensive agricultural lands known for heavy fertilizer and pesticide use.
5. Illegal Mining Sites: Identified locations of illegal sand mining operations along the riverbanks in Nanded or nearby talukas.
6. Downstream Impact Sites: Further downstream from Nanded to assess the cumulative impact of all pollution sources and potential recovery zones.

**4.2 Water Quality Assessment**

Water samples will be collected season wise from all designated sampling sites for a period of period of throughout year.

The water quality analysis will include various pollution-related parameters. Physicochemical parameters such as temperature, pH, electrical conductivity, turbidity, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total dissolved solids (TDS), chlorides, sulfates, nitrates, and phosphates will be analyzed following APHA and BIS (IS 10500:2012) standards. Heavy metals like iron (Fe), copper (Cu), manganese (Mn), zinc (Zn), lead (Pb), cadmium (Cd), arsenic (As), and mercury (Hg) will be tested using ICP-MS or AAS techniques. Organic pollutants, including pesticide residues and pharmaceutical compounds, will be analyzed using GC-MS or HPLC methods.

### 4.3 Fish Sampling and Species Selection

Fish sampling will be conducted quarterly from the selected sites, ensuring ethical collection practices and adherence to all necessary permits.

1. Species Selection: Based on their ecological role, economic importance, and prevalence in local markets, three fish species will be selected for detailed study.
2. Sample Size: A statistically significant number of individuals per species per site will be collected to ensure robust data.
3. Ethical Handling: Fish will be handled humanely, anesthetized, and euthanized according to CPCSEA guidelines before tissue collection.

### 4.4 Impact on Fish Fecundity

The fecundity of female fish will be assessed by counting the number of mature eggs, including both absolute and relative fecundity. Additionally, oocyte diameter (egg size) will be measured. This evaluation will help determine the impact of pollution on the reproductive capacity of female fish.

### 4.5 Data Analysis and Interpretation

All collected data will be subjected to rigorous statistical analysis. This includes descriptive statistics, inferential statistics (e.g., ANOVA, t-tests, regression analysis) to identify significant differences and correlations, and multivariate analyses (e.g., Principal Component Analysis, cluster analysis) to identify pollutant sources and their interrelationships.

## National and International Status:

The Godavari River, an important river in India, especially around the Nanded region, is increasingly affected by pollution. This pollution is having a harmful impact on the fecundity (reproductive capacity) of several fish species living in the river. Domestic and

industrial wastes, including heavy metals, chemicals, and sewage, reduce the number of eggs fish produce and cause abnormalities in their development. Studies conducted by Indian scientists on the fishes of the Godavari River have shown that pollution negatively affects the reproductive health of fish, which can lead to a decline in fish populations and harm the local fisheries and fish farming industries. Although the government has launched programs to improve water quality, more focused efforts are still needed in this area.

At the international level, pollution's effect on fish fecundity in rivers is also a serious concern. Major rivers around the world such as the Amazon, Yangtze, and Nile face similar pollution challenges. Scientific research globally shows that pollution disrupts fish hormones and reduces their ability to reproduce effectively. Additionally, pollutants like microplastics cause further biological harm to fish development. International organizations such as the United Nations and the Food and Agriculture Organization (FAO) are working collaboratively to clean polluted waters and protect aquatic life. India actively participates in these international efforts.

Thus, the impact of pollution on fish fecundity in the Godavari River is an important issue both nationally and internationally. Understanding and addressing this problem is vital for sustaining local fish populations, supporting livelihoods, and ensuring environmental sustainability through coordinated and long-term efforts.

## Study area: Godavari River, Nanded, Maharashtra

### Proposed work plan with tentative chapter scheme /Formulation and structure of the study:

- Introduction.
- Review of literature
- Research methodology
- Fish fecundity
- Water analysis of fish habitat
- Data analysis and Interpretation
- Result and Discussion
- Conclusion
- References

## Outcome

- This study will be a new contribution to the field of fishery science and will provide recommendations to the government for enhancing the health of aquatic ecosystems.
- In polluted regions of the Godavari River, fish have elevated levels of pollutant such as zinc and mercury, which negatively impact their growth rate, reproductive capacity, cause abnormal behaviors, and lead to various diseases.

- If humans consume fish contaminated with high levels of pollutant frequently, there is a risk of developing health problems like kidney damage and weakened immune system.
- Excessive accumulation of mercury in the human body can harm the nervous system and also adversely affect developing fetuses.

## Reference:


1) A comprehensive Review on the Impact of Aquatic Pollution on Fish, Volume: 14, Issue: 01, Year: 2025, Starting Year 2012.
2) Assessment of Godavari River Water Quality of Nanded City, Maharashtra, India, (P. R. Shaikh, Girish Deore, A. D. Pathare, D. V. Pathare & R. S. Pawar) First Online: 20 June 2021
3) Britannica water pollution (online website) 23 April 2025.
4) Central Pollution Control Board (CPCB), online/ website, Latest update 8 April 2025.
5) Effects Of Water Pollution On Fisheries Sector, Dr. Babu Rao Gundi Head Department of Zoology N.B. Science College & PG Centre Chakraman, Hyderabad-500002, (Volume 4, Issue 2 June 2016).
6) International Journal of Life Sciences Research, STUDY OF FISH MARKET IN NANDED CITY, MAHARASHTRA (INDIA) K. S. Shinde, D.V. Totawar, Department of Fishery Science, Science College, Nanded. (M.S.), Month: January - March 2019, Available at: www.researchpublish.com
7) Medicover Hospital (website) Medicover Environmental Policy, 2 November 2021
8) Monitoring of Water Quality and Pollution Status of Godavari River in and Around Nashik Region, Maharashtra Resham Bhalla and B. B. Waykar. Received: 7-9-2012 Accepted: 17-10-2012.
9) Research article - The study on fish diversity in the Vishnupuri dam, Nanded (M.S.) India (Pawar S.D. (Department of Fishery Science), Science College, Nanded, Maharashtra. Vasantrao (kotyal), T. Mukkhed Dist. Nanded, (M.S.) India).
10) Water pollution facts and information, National Geographic (online/website) 16 March 2010.
11) Water Pollution with Special Reference to Pesticide Contamination in India. (Journal of Water Resource and Protection, Vol.2 No.5, May 2010. By Anju Agrawal, Ravi S. Pandey, Bechan Sharma)
12) www.punekarnews.in (News channel website) 23 February 2025.


Research Scholar

Mr. Biyabani Munibuddin Muntajebuddin

Research Guide

Dr. Malviya Mamata Kashiramji

Dr. Malviya M. K.
Research Guide (Zoology)
Pratibha Niketan College,
Nanded